Can Institutional Economics Inform the Efficient Market Hypothesis?

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Abstract:

The current financial crisis is a crisis of theory as well. The dominant theory of financial markets, the efficient market hypothesis (EMH), states that in an efficient market the price of a financial asset reflects publicly available information about that asset. Competing theories, such as behavioral finance, argue that other factors, including irrational investor behavior, impact the price of financial assets. We argue, however, that an analysis of market institutions can help explain when and why the EMH works. Although not widely examined, we argue it is significant that until very recently the New York Stock Exchange (NYSE), whose listed companies’ price behavior inspired the EMH, was a nonprofit organization. Thus, we apply an economic theory of nonprofits to the NYSE to identify the incentives of Exchange members and the various governance mechanisms they created in response. Together, these mechanisms generated what we term “synthetic inertia”, which made prices on the NYSE relatively well-behaved. We hypothesize that NYSE demutualization—converting from nonprofit to for-profit—altered the incentives of the NYSE and undermined this synthetic inertia and thus informational efficiency. We test our hypothesis by comparing bid-ask spreads, a measure information quality, at the NYSE and NASDAQ and find that bid-ask spreads on the NYSE were consistently lower than the NASDAQ (suggesting better information quality at the NYSE) but that spreads converged after demutualization. We believe that our approach helps resolve an apparent tension between competing theories of market behavior and contributes an analytical framework from which to consider regulatory changes.

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Introduction

At the heart of the still unfolding financial crisis is a crisis of theory as well. For nearly four decades our thinking about financial markets has been guided by the theory of market efficiency. Fama (1970), among others, developed the “efficient market hypothesis” (EMH) to demonstrate that available information about a capital asset is fully reflected in the price of that asset. In relatively short order, the EMH became widely accepted; Jensen (1978) claimed “there is no other proposition in economics which has more solid empirical evidence supporting it than the Efficient Market Hypothesis.” Indeed, the theory has been widely and successfully tested using price data of publicly traded securities (Fama (1970); Jensen, 1978; Malkiel, 2003) and continues to serve as the basis of regulatory policy, academic research and investment strategy.

But the recent collapse of global credit markets, the latest in a series of financial crises over the last 20 years, has contributed to a growing loss of confidence in the EMH (Soros, 2010; Malkiel, 2003), as scholars and investors wonder how prices could have misled investors so radically and so frequently. This development has opened the door to other explanations for asset pricing, most prominently behavioral finance, which argues

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1 Fama (1965) states that “many of the ideas in [his] paper arose out of the work of Benoit Mandelbrot.” In addition to Mandelbrot, key figures included Samuelson (1965), Kendall (1953), Roberts (____) and Cootner (1964). The much older work of Bachelier (1900) is also now understood to have been important to the modern development of the EMH.

2 The modern securities regulation regime, particularly its federally imposed mandatory disclosure obligations, is built upon acceptance of the EMH. The EMH also underpins the grounds upon which securities class action lawsuits are filed. Basic Inc. v. Levinson 485 U.S. 224 (1988).

3 For example, informational efficiency allows for event studies—which are too numerous to cite—in which the market’s reaction to an announcement or action by a publicly traded firm can be gauged by changes in stock price.

4 These include the savings and loan crisis of the early 1990s, the dotcom bubble of the late 90s, and the telecom bubble of the early 2000s. These cover just the advanced economies, but in the same time frame there has also been the peso crisis in Mexico, the Asian financial crisis and the collapse of Argentina.
that investor irrationality interferes with the mechanisms of market efficiency (Akerlof and Shiller, 2009; Kahneman, Slovic and Tversky, 1982; Soros, 2010).

Rather than reject the EMH and search for a new paradigm, however, we argue for an institutional analysis of financial markets. In the process, we uncover mechanisms that aid informational efficiency and identify a critical consideration that was omitted by EMH theorists: inertia.\(^5\) We begin by observing that stock exchanges and other financial exchanges were, until recently, organized as nonprofits. We apply an economic theory of nonprofits (Kuan, 2001) to the two largest US stock exchanges, the NYSE and the NASDAQ. According to that theory, “consumers” of a nonrival good\(^6\) (in this case, a “marketplace”) organize themselves to produce that good; this framework makes it possible to identify a clear objective function for the nonprofit. We show that:

1. Unlike for-profit firms, which all maximize profit, nonprofits can differ from each other in their objectives since their owners can differ; nevertheless, these heterogeneous objectives can be identified and analyzed; and

2. The nonprofit NYSE had an incentive to produce a high quality marketplace and to employ mechanisms that generated market efficiency (Coffee, 2001).

In particular, we argue that underwriters (i.e., investment banks), who represent firms seeking capital, organized the NYSE in order to create a market for shares for their

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\(^5\) A growing literature in finance, sociology and elsewhere has begun to recognize the importance of institutional analysis with respect to economic development and the financial sector. Weber, Davis and Lounsbury (2009), for example, examine financial market institutions, and Davis and Marquis (2005, p. 355) explain, “some institutional configurations are better than others for generating economic growth… and institutional analysis can guide public policy by locating the best-performing model of economic organization and transplanting relevant elements….” Others have also argued that exchange governance, more specifically, matters. For example, Kim and Purnanandam (2009) and Kim and Lu (2009) argue that good governance improves investor confidence. By contrast, behavioral finance, like EMH approaches, relies on an analysis of individual behavior not institutional analysis.

\(^6\) Here, a nonrival good refers to a good that can be consumed by multiple consumers without degrading the quality of that good.
clients. The resulting exchange was a source of market power for underwriters, helping them, collectively, to restrict “output,” i.e., the number of client firms listed on the Exchange. But this market power benefited client firms because output restrictions addressed the “lemons” problem between listed firms and investors (Akerlof, 1970). In short, because an efficient market would result in higher underwriting fees, the underwriter-owners of the NYSE had an incentive to produce a market with such features as high listing standards, analyst research, monopolistic market makers and rules dictating the orderly movement of stock prices.

This contrasts with the NASDAQ, whose broker-dealer members profit from information asymmetry rather than its reduction. Broker-dealers conduct trades for buyers and sellers and therefore profit directly from the bid-ask spread, the difference between the price a buyer is willing to pay and that a seller is willing to accept. But this bid-ask spread is also a measure of information quality in a market. Because the spread is the primary source of profit for NASDAQ members, the NASDAQ faces polar opposite incentives from the NYSE. Institutional features of the NASDAQ reflect this difference in incentives, as do bid-ask spreads. We show that before the NYSE demutualized—converting from nonprofit to for-profit—bid-ask spreads at the NYSE were consistently lower than at the NASDAQ, implying better information quality at the

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7 Our claim that underwriters created the market that inspired the EMH sets our analysis apart from existing work on market institutions which focuses on trading, often to the exclusion of underwriting. This literature includes work on the use of technology or electronic trading (Cantillon and Yin, 2007; Stoll, 2005; Aggarwal, 2002; Domowitz, 1990; Hasan, Malkamaki and Schmiedel, 2003), trading costs (Huang and Stoll, 1996; Venkataraman, 2001; Pagano and Roell, 1996; Christie and Huang, 1994; Handa, Schwartz and Tiwari, 2004) and “specialist” firms that execute trades (Benveniste, Marcus and Wihelm, 1992; Corwin, 1999, Madhavan and Panchapagesan, 2000; Battalio, Ellul and Jennings, 2007). With the exception of Macey and O’Hara (1999), studies that examine the nonprofit organization of exchanges also regard trading as the primary function of exchanges (Serifsoy, 2007; Saloner, 1985; Pirrong, 2000; Hart and Moore, 1996; Domowitz and Steil, 1999).
NYSE. After demutualization, which made the NYSE’s objective function similar to the NASDAQ’s, bid-ask spreads at the NYSE grew to above-NASDAQ levels.

The pre-demutualization mechanisms in place at the NYSE constituted what we term “synthetic inertia,” a key element of an efficient market that was omitted by the foundational EMH theorists and their epigones.\(^8\) It is helpful to recall that the EMH originally drew from theory developed in physics and mathematics that described the movement of colliding particles.\(^9\) In essence, the EMH compares the random motion of colliding particles to the behavior of stock prices colliding with “bits of information” (Fama, 1963). This analogy allowed theorists to apply useful mathematical principles and statistical techniques to the behavior of prices,\(^10\) but early theorists omitted consideration of the role of inertia, which is present in the original, physical context and is necessary to describe colliding particles.\(^11\)

The failure to account for inertia in the social world was acceptable as long as “synthetic” inertia was being produced, unnoticed, by the NYSE. However, now that the

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\(^8\) The one near exception in this intellectual milieu is Mandelbrot who stated in an interview in 2009 that there is no inertia present in the financial markets thus the price of a stock can fall from 100 to zero instantaneously (Mandelbrot, 2009). While we disagree that this must, in fact, always be the case, at least Mandelbrot’s statement confirms our position that the question of inertia must be considered.

\(^9\) The French mathematician Bachelier (1900) first described prices on the French Bourse as following what is now known as a “Brownian motion,” the random motion of molecules observed in the study of thermodynamics.

\(^10\) For example, “continuous” functions are critical to the arguments for the EMH as well as related arguments such as the Black-Scholes-Merton options pricing model. The EMH assumes that price changes are incremental and small thus mimicking the “continuous” movement of objects in the physical world. This means that price changes cluster closely around the mean and that the distribution has narrow tails. Physical world continuity is a result of the role of inertia, which states that unless an object is subjected to a new force it will remain at a constant velocity. As will become clear we think it is possible to have markets with something akin to continuity but only when the proper institutional arrangements generate what we term here “synthetic inertia.”

\(^11\) Molecules would behave very differently without inertia. In fact, it would be hard to call the result “behavior” – the universe as we know it would simply not exist. Inertia must be “present” for models of the physical world to work.
NYSE has demutualized and its incentives have changed, inertial properties have weakened or failed, calling for new attention to be paid to this omitted principle. Our analysis generates the counter-intuitive result that the nonprofit NYSE allowed underwriters to collude openly, but that collusion created an incentive to produce “synthetic inertia” and thus market efficiency. A demutualized NYSE can thus be expected to have a negative effect on market efficiency. Our refinement of the EMH, which redresses an important omission, enables that theory to continue to inform exchange governance and regulation.

**On the purposes and problems of a stock market**

Stock exchanges appear to typify impersonal exchange with numerous anonymous buyers and sellers of identical “goods” coming together to transact at arms length. Indeed, it is easy to think of stock exchanges as archetypal markets. But for over 200 years, the NYSE was a privately held firm, more specifically, a member-owned nonprofit firm. In 1971, the NASDAQ emerged as the “automated quotation” system of the National Association of Securities Dealers (NASD) and was also organized as a member-owned nonprofit. In this section, we argue that despite their superficial similarities, these two exchanges are fundamentally different. In the process, we show that nonprofits are susceptible to analysis like for-profit firms, but unlike for-profit firms, they reflect significant heterogeneity.

A stock exchange brings together entrepreneurs in need of capital and investors with funds to invest. This basic problem has been solved many different ways in many different settings but always involves a matching up of investor with investment.
Investors range from large multi-billion dollar pension funds to individuals with modest savings in an individual retirement account. Investment opportunities range from Silicon Valley start-ups to the standardized debt instruments or commercial paper issued by triple-A rated corporations and financial institutions. Intermediaries in this matching process thus include parties with information about investors, investments, or both. For example, private money managers have access to investors, their clients, whose funds they invest in a combination of investment vehicles marketed by others. Meanwhile, venture capitalists work with both investors and investments, using funds from known associates to finance entrepreneurial firms that they find, evaluate, and oversee.

While venture capitalists perform both intermediation functions, it is important to note that the two functions - bringing investors to the market and bringing investments to the market - are analytically, and practically, distinct, particularly in a stock exchange setting. Thus, in the parlance of Wall Street, the world is divided up into “buy side” and “sell side” firms. Hedge funds and pension funds are on the “buy side,” while investment banks like Morgan Stanley or Goldman Sachs are “sell side” firms. We therefore consider the two separately.

**The “Type A” Exchange: NYSE as an Underwriter-based Stock Exchange**

Underwriters bring investment opportunities to the market; their clients are firms seeking capital. In a “public offering,” shares of an underwriter’s client firm are made available for purchase to all investors; buying and selling of such shares takes place at a public market, of which the NYSE is an example. Public offerings are distinct from

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12 We ignore for the sake of argument that in practice, many investment banks have internal “buy side” operations. Their main business for the NYSE is to operate on the “sell side.”
private placements in which underwriters sell shares of their client firms to accredited investors and the shares are unavailable to the wider investing public.

An underwriter’s profit function is the canonical profit function of a firm that produces and sells a good or, in this case, a service:

\[ (x) = p\cdot x - c\cdot x, \]

° \( x \) = quantity produced and sold; in this case, the number of clients serviced
° \( p \) = price
° \( c \) = cost of production; in this case, the cost of servicing a client\(^{13}\)

In theory, under perfect competition, the zero-profit condition holds so price equals marginal cost. But monopoly conditions allow a firm to make positive profits by reducing output and raising price above marginal cost. Intermediate between these two extremes is a collusive oligopoly outcome in which quantities produced are less than that produced under perfect competition but more than that produced by a monopolist. Should underwriters be able to collude, they would make positive profits.

We now make the claim that the NYSE is the result of underwriters organizing a public marketplace for their clients’ shares. This claim is based upon a theory of nonprofit governance developed in Kuan (2001), which argues that nonprofit organizations are created when the main consumers of a nonrival good organize to produce that good.\(^{14}\) In the case of the NYSE, underwriters provide more value to their

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\(^{13}\) In practice, underwriters buy the shares of their client firms and then sell them to investors, thus one component of underwriting cost are capital costs. Also, while this two-step transaction usually goes smoothly, underwriters are nevertheless exposed to substantial losses if investors (buyers) renege.

\(^{14}\) There is a small literature on the nonprofit organization of stock exchanges that mostly focuses on the organization of trading. The exception is Macey and O’Hara (1999), who argue that the nonprofit firm allows underwriters and their clients (or “listed firms”) to share power on the exchange, mitigating opportunism by one party or the other.
clients the more liquid the market for shares is, so underwriters benefit directly from a public marketplace.

To test our claim, suppose underwriters organized a stock exchange. Each underwriter earns revenues by providing underwriting services to clients at cost, $c$, and charge clients who wish to list their securities on the Exchange a price, $p$. Assume underwriters have identical objective functions. Then an underwriter-organized stock exchange would have the same composite objective function as its members, and would be optimized under monopolistic conditions (since there would be no competition as all underwriters are organized into a single entity). If this is the case, then an underwriter-organized exchange will behave such that market power is achieved for its member underwriters.

Against this prediction, we consider actual practices at the NYSE. First, according to anecdotal evidence, investment banks dominated the board of the nonprofit NYSE,\textsuperscript{15} even though “specialists”\textsuperscript{16} and broker-dealers were also members, suggesting that the interests of underwriters were especially well represented within the governing body. Next, listing requirements, the standards firms must meet in order to list shares on the NYSE, were particularly onerous, excluding the vast majority of firms. These onerous listing standards effectively restricted the collective “output” of underwriters, raising the price underwriters could charge their clients.

Underwriters also employed other measures to increase their fees by improving the informational efficiency of the market, which increased the value to clients of listing on the Exchange. According to Akerlof’s “lemons” problem (1970), information

\textsuperscript{16}“Specialists” are unique to the NYSE, whose function is to execute trades.
asymmetry between sellers (listed firms) and buyers (investors) would lead buyers to offer too low a price to induce sellers to sell. Solving the lemons problem involves reducing information asymmetry between parties so that buyers are willing to pay a price that sellers will accept. Examples of mechanisms that reduce information asymmetry include stock analyst research produced by underwriters\textsuperscript{17} and a “hostage” system for extracting truthful disclosure on an on-going basis (Diamond and Kuan, 2007).

Finally, the nonprofit NYSE implemented a “specialist” system, in which a single specialist was granted a monopoly opportunity, and at times an obligation, to fulfill buy- and sell-orders for each stock. This internal monopoly allowed specialists to charge a transaction fee \textit{and} profit from the bid-ask spread. The effect of this two-part tariff is to lower the optimal spread vis-à-vis competitive (non-monopoly) market makers who compete away the transaction fee. Since the bid-ask spread is also a measure of informational efficiency, the monopoly market-maker arrangement improves the alignment of specialists’ incentives with those of underwriters. In addition to a lucrative trading monopoly, specialists were also subject to significant trading rules. Specialists were required to serve as buyer or seller of last resort and limited in the amount a stock price could change from one transaction to the next. That is, the price of a stock was to move in an “orderly” fashion. The cost to the specialist of these rules cannot be overestimated; in a stock market crash, specialists risk losing everything as they buy rapidly declining stocks while attempting to temper price declines. Their obligation in

\textsuperscript{17} Underwriters produce reports analyzing individual stocks that trade publicly. While investors typically pay for analyst research, we infer from recent events that these payments are not sufficient to cover the cost of producing research. In 2003, as part of a global settlement of litigation with major investment banks, the SEC placed new constraints on the ability of underwriters to produce analyst research due to conflicts of interest (as underwriters “analyzed” stocks that they also underwrote). In addition, the NASD and NYSE put in place new rules that aimed to solve the conflict problem.
such circumstances can be akin to catching a falling knife. These rules are examples of the “synthetic inertia” introduced by the NYSE to create an orderly market.

To summarize, we have argued that underwriters organized the NYSE, which allowed them to collude openly to limit output. Restricting output and raising prices had the added benefit of limiting listed firms to those willing to pay the highest underwriting and listing fees. These are also likely to have been the most profitable firms. Thus the high fees served as a selection mechanism that helped the Exchange establish a reputation among investors for quality and stability. Thus, we arrive at a counter-intuitive result, that collusion can produce positive externalities, i.e., collusion is “good,” producing a virtuous circle of higher fees, better firms, more investors, and more liquidity.

Nonetheless, because the resulting organization is a member governed nonprofit many of its features have been misread as inefficient or “archaic.” For example, until its IPO, membership of the NYSE was fixed at 1,366. Prospective members required nomination by three existing members and could be opposed by other members. The Exchange was thus often criticized as exclusive and “clubby.” Yet these arrangements served well the goals of a highly effective cartel.

18 Note that achieving output limits is a common challenge for cartels: while all members benefit from the higher prices associated with lower total output, each individual member benefits by defecting from the group and raising output. Thus cartels must detect and punish defectors, which can be costly; in the case of OPEC, a dominant member like Saudi Arabia, must sacrifice output.

19 As former SEC Chairman and later Supreme Court Justice William O. Douglas (1940) wrote: “Operating as private-membership associations, exchanges have always administered their affairs in much the same manner as private clubs. For a business so vested with the public interest, this traditional method has become archaic.”
The “Type B” Exchange: The NASDAQ as a Trader--based Stock Exchange

On the “buy side” of the market are brokers who service investors interested in buying or selling stocks. As trading intermediaries for buyers and sellers, they profit from the differential between buyer and seller prices.

Thus, their objective function is:

\[(y) = n \cdot (p_s - p_b) \cdot y - f\]

\(n\) = the number of items available to be bought or sold, e.g. listed stocks
\(p_s, p_b\) = the seller’s price and buyer’s price, respectively
\(y\) = the number of transactions
\(f\) = a fixed cost of production

The precise functional form of the profit equation is not critical; what is important is the role of the bid-ask spread, \((p_s - p_b)\), as the source of profit. The broker-dealers that make up the NASD are characterized by this objective function.\(^{20}\)

We now argue that broker-dealers formed the NASDAQ, each with the above objective function. The resulting organization is a nonprofit firm with the same objective function that produces incentives the polar opposite of those at the underwriter-owned NYSE. That is, profits increase with the bid-ask spread; since the greater the bid-ask spread, the poorer the information quality, the NASDAQ has no incentive to enhance information quality, which stands in stark contrast with the NYSE.

\(^{20}\) While investment banks may also be members of the NASD, there are over 4000 broker-dealers while investment banks number in the dozens. Thus the membership of the NASD is dominated by trading intermediaries rather than underwriters. There is anecdotal evidence that some investment banks increased their activity on NASDAQ to take advantage of the revenue opportunity offered by this model, particularly in the late 90’s tech bubble period.
Institutional features of the NASDAQ are consistent with this analysis. Listing requirements are far less demanding, which results in a greater number of listed firms and thus greater trading revenues. But unlike underwriters, broker-dealers perform very little stock research if any, and it is usually of lower quality than that issued on NYSE firms. The poor information quality can be seen in lower stock prices (or market valuation). To compare, we note that stocks listed on the NASDAQ outnumber those listed on the NYSE by three to one (approximately 4500 to 1500, respectively) while the market capitalization of the nonprofit NYSE was greater than that of the NASDAQ and the London Stock Exchange (the next two largest exchanges) combined.

Unlike the monopoly specialists of the NYSE, market making on the NASDAQ is competitive by rule. In order for a firm to list its shares on the NASDAQ, it must enlist at least three market makers to deal in its stock. This requirement increases the chances that a buyer or seller will exist for a stock, but it is no guarantee because unlike the NYSE, the NASDAQ does not require its market makers to be buyers or sellers of last resort. The three market maker rule also results in direct competition among market-makers who then compete away their ability to price discriminate and charge a two-part tariff; the small transaction fee market makers still charge merely covers costs.

In short, an exchange formed by broker-dealers has design features that are exactly opposite to those of an exchange formed by underwriters, both in terms of information quality and exclusivity.22

21 A persuasive example of the abuse of the IPO shares allocation process, the infamous “Friends of Frank” game organized by investment banker Frank Quattrone in Silicon Valley during the dot com era of the late 90s took place, not surprisingly to us, on the NASDAQ not the NYSE (Knight, 2002).
22 A third type of exchange arose in the 1990s: the electronic communications network, or ECN. Like broker-dealer based exchanges such as the NASDAQ, ECN’s also rely on trading volume for revenues. They serve merely as an automated matching service without any of the diligence or monitoring functions
Empirical Analysis

To test our theory that the NYSE is organized to produce an informationally efficient market while the NASDAQ is formed to profit from inefficiency, we apply an empirical approach that is widely used in the literature. We use the bid-ask spread as a measure of information asymmetry or information quality, and compare spreads from the NYSE with those from the NASDAQ. Figure 1 plots the un-weighted averages of the NYSE and NASDAQ over the period 1995 to 2008. It shows that spreads on the NASDAQ are consistently higher than those on the NYSE. For a different view of the same data, figure 2 plots the difference of the un-weighted averages.

In the recent demutualization of the NYSE, the Exchange reorganized as a publicly traded for-profit corporation, shifting from its previous longstanding status as a member-owned nonprofit firm. This event provides an additional opportunity for

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23 Huang and Stoll (1997) decompose the bid-ask spread into three components: inventory holding costs, transaction costs, and adverse selection. For our purposes, we compare bid-ask spreads before and after an event. We think it is reasonable to assume that inventory holding costs are unaffected by the event, and that transaction costs would remain unchanged or decline after the event (de Fontnouvelle, et al., 2003). So our analysis would detect any changes in information asymmetry, i.e., adverse selection.

24 The bid-ask spread is used to measure information quality in a variety of markets, including electricity (Mansur and White, 2007) and used cars on eBay (Lewis, 2007), as well as in financial markets (including the effects of both early federal securities regulation (Daines and Jones, 2007; Mahoney and Mei, 2007) and the 2002 Sarbanes-Oxley Act (Jain et al., 2006). Bacidore and Sofianos (2002) also use bid-ask spreads to show that information asymmetry is greater for foreign stocks traded on the NYSE than for US-listed stocks. Bid-ask spreads contribute to the empirical financial literature that seeks to estimate the effects of disclosure regulation. Stigler (1964) and Bentson (1973) use stock price improvements to examine the Securities Exchange Act of 1934, Greenstone et al. (2006) use excess returns to measure the effects of the 1964 amendments to federal securities laws that required firms listed on the NASDAQ to meet the same disclosure requirements as those on the NYSE, and Begley et al. (2007) use variance in financial analyst forecasts to estimate the effects of the 2002 Sarbanes-Oxley Act.

25 On March 6, 2006, the NYSE merged into Archipelago Holdings, Inc., the owner of an electronic trading platform, which was already publicly traded. The newly formed merged company took the name NYSE Group, Inc. The exchange itself became the New York Stock Exchange LLC, a wholly owned subsidiary.
comparison with the NASDAQ. In particular, because the NYSE merged with Archipelago, an already publicly traded for-profit electronic communications network (or ECN), we predict a change in objective function for the NYSE that incentivizes the NYSE to behave in a manner similar to the NASDAQ.26 Descriptively, figures 1 and 2 show a change in the relationship between NYSE and NASDAQ spreads after demutualization, with NYSE spreads rising above those of the NASDAQ after the NYSE’s demutualization.

Our view of the NYSE demutualization differs from that of other observers. The worldwide process of stock market demutualization began in 1993 in Sweden. Since then, demutualizations have swept Europe and Asia (Aggarwal, 2002), ending in the U.S. with the NYSE as the last hold out. This thirteen-year “long march” of demutualizations and a lengthy, years-long debate within the NYSE about the process, have given observers and scholars time to consider the causes and implications of demutualization. For most, demutualization has been regarded as a long overdue modernization of “archaic” nonprofit clubs. In addition to being viewed as dated, nonprofits are seen as capital-constrained and thus unable to finance the new technology needed by today’s high speed trading strategies and increased liquidity (Aggarwal, 2002). Karmel (2002) argues that electronic trading challenged what was once the natural monopoly position of established exchanges. In short, the supposed advantages of demutualization became orthodoxy among most analysts, an orthodoxy that our analysis challenges.

of NYSE Group. NYSE Group became NYSE Euronext when it merged with Euronext, itself a merger of several European exchanges, in 2007.

26 The NASDAQ demutualized, too, first selling shares to the public in 2002, but broker-dealers retained effective control until the end of 2006. Thus, while the exchange was nominally publicly traded from mid-2002, the National Association of Securities Dealers owned preferred stock that gave it voting control over the exchange until the end of 2006. Moreover, our analysis predicts no changes in its objective function with a change in governance structure or demutualization.
Data

We perform two estimations, both using daily closing information from all common stocks trading on the NYSE and NASDAQ. To address any seasonality in pricing, we sample from the same day, March 7, in each year (but plan to eventually use weekly data as well as perform robustness tests). We also show data from the last four months of 2008, the most recent data available, to include the impact of the recent banking crisis and plan to add data as it becomes available.

We define the bid-ask spread as the highest asking price minus lowest bid price on each day divided by the closing price that day. Closing bid and ask prices could also have been used with similar results. Roll’s (1984) specification for the bid-ask spread, which some of the other studies listed above use, was less appropriate given the long time period and weekly sample in this study.

Because NYSE-listed firms have larger market capitalization values than NASDAQ-listed firms, we control for size by using S&P 500 data. Standard and Poor’s compiles a list of the 500 largest firms by market capitalization each year. While this group of firms is largely regarded as representative of the market, only about ten percent of the S&P 500 is NASDAQ-listed. S&P data are available for the same date, March 7, of each year for the period 2001 to 2008. They also provide the global industry classifications (GIC) for each firm, which allow us to control for industry more easily than the standard industry classifications (SIC) used by CRSP.
**Estimation and Results**

Our first model is a “difference in differences” model comparing the NYSE with the NASDAQ before and after NYSE demutualization. We estimate the equation:

\[ \text{bid-ask spread} = a + b_1 \text{ (exchange)} + b_2 \text{ (after demutualization)} + b_3 \text{ (exchange*after)} + b_4 \text{ (earnings/price)} + \text{industry dummies}. \]

We predict that the bid-ask spreads of the NASDAQ will be higher than those of the NYSE before demutualization but not after demutualization. Table 1 shows our results for all stocks (column 1) and for large firms only (column 2). We find that in both specifications, the bid-ask spreads are lower for NYSE-listed stocks than for NASDAQ-listed firms, but that spreads are higher for the NYSE after demutualization.

Our second model is a trend analysis. For intuition, we plot the difference between NYSE and NASDAQ spreads in Figure 2. Figures 3 and 4 show the trend line excluding post-demutualization data and then including post-2006 data. Notice that the trend line changes from a positive to negative slope. Our regression estimates the following equation:

\[ \text{bid-ask spread} = a + b_1 \text{ (NYSE year trend)} + b_2 \text{ (NYSE year trend * after demutualization)} + b_3 \text{ (earnings/price)} + \text{industry dummies} \]
As before, we use two samples. First, we estimate the model using all stocks and then estimate it again using the S&P 500. Results, reported in Table 2, show that the NYSE year trend is positive after demutualization, as predicted.

Discussion & Conclusion

A key principle was “lost in translation” when the foundational EMH theorists adapted some core ideas from physics to economics: inertia. In the physical world where inertia is operative, an object at rest tends to stay at rest unless impacted by a new force (such as gravity or acceleration) while an object in motion tends to stay in the same motion unless impacted by a new force. When physical objects are impacted by other objects in motion they move in a manner that is now described as a “Brownian motion,” where the changes are small and continuous. We suggest that if the changes in prices of a financial asset appear to follow a similar “Brownian motion,” with its associated normal distribution, it is because the governance mechanisms put in place by the exchange where the financial asset is traded generate what we call “synthetic” inertia which constrains the size and volatility of price changes such that a mild and continuous, as opposed to wild and discontinuous, distribution is possible (Taleb, 2007). Thus, we argue, it is synthetic inertia that causes price changes of financial assets to follow the familiar “random walk” in which news is rapidly and smoothly incorporated into prices and whose movements are thus continuous and independent. However the opposite is also true; if synthetic inertia deteriorates, then price volatility increases. Indeed, mathematician Benoît Mandelbrot (2009) has said that in the absence of inertia, nothing prevents the price of an asset from going from 100 to zero instantaneously.
While the current economic crisis has made criticism of the EMH seem new, it has been controversial for decades. Bachelier established the foundations of the EMH by observing the orderly behavior of asset prices on the fin de siècle French Bourse. Mandelbrot (1963) then provided an early critique of the EMH based largely on the erratic behavior of cotton prices on the New York Cotton Exchange (NYCE). What explains these vastly different observations? In 1900, the French Bourse, a tightly regulated member-governed institution, had in place onerous restrictions on membership and listings similar to those of the nonprofit NYSE, while the NYCE more closely resembled the NASDAQ in its lack of self-regulation. The NYCE was, thus, an environment in which, according to one analyst, “high volume and manipulation went hand in hand” (Pirrong, 1995). We believe that this historical argument finds its modern counterpart in our story of two exchanges.

By carefully analyzing the NYSE and NASDAQ as nonprofits, we uncover the omitted factor, synthetic inertia, and thereby reconcile the EMH and its now widening array of critics. We argue that it is significant that underwriters formed the NYSE while traders created the NASDAQ. The different profit functions for each type of founder is reflected in the objective functions of their resulting exchanges. These objective functions differ fundamentally and generate polar opposite incentives with respect to informational efficiency and the governance mechanisms that give rise to synthetic inertia. Thus, despite superficial similarities between the two nonprofit exchanges, polar opposite incentives and outcomes co-exist; one exchange becomes a well-behaved safe haven for high quality firms, the other a volatile, bubble-prone market.
Our analysis also has predictive implications. Unlike earlier analyses of
demutualization, we argue that demutualization will affect the NYSE and NASDAQ very
differently. The demutualization of the NYSE ends an important capital market
institution. The resulting decline in information quality will raise the cost of capital for
good firms and create new risks for investors. Already we observe a race to attract new
listings driving the formerly selective NYSE (which, in the last bubble, eschewed most
dot-com listings) to compete with the NASDAQ for firms of questionable integrity.²⁷ In
this sense, a “democratization” of listings actually eliminates investment choices as blue
chip firms become indistinguishable from riskier firms. The “lemons” problem that the
NYSE so cleverly solved (by a cartel, no less) now casts a shadow over this 200-year old
pillar of capitalism.

Research questions remain. First, if the nonprofit NYSE was so effective, why did
it demutualize? One possibility lies in new competition from electronic communications
networks (ECNs), which were granted exchange status by the Securities Exchange
Commission and thus allowed to trade NYSE-listed stocks. Eliminating the NYSE’s
trading monopoly reduced the NYSE’s share of trading volume as investors chose ECNs’
faster execution of trades over the better prices available at the NYSE. But the erosion of
synthetic inertia caused by the loss of its monopoly combined with an apparent growth in
trading profits for underwriters that diversified into trading over the last several decades
may have weakened the commitment to the nonprofit model of the NYSE.

²⁷ Russian firms, for example, are subject to government intervention, manipulation, and expropriation. As
a result, there is a lack of confidence in disclosures by these firms. However, after demutualization, the
NYSE’s historical lack of interest in allowing Russian firms to list has been reversed. “We are honored to
welcome Alexey Kidrin, the Russian Finance Minister, on his official visit to the New York Stock
Exchange,” NYSE Group, Inc. President and co-COO Catherine R. Kinney explained in 2006, the year of
the NYSE IPO. “The NYSE is proud of our partnership with Russia and our growing list of Russian listed
companies. We look forward to expanding our relationship with Russia” (NYSE, 2006).
Second, despite the international trend of exchange demutualization, we focus on the two main U.S. exchanges, the NYSE and the NASDAQ, because unlike the quasi-state-owned exchanges found widely abroad, U.S. exchanges are autonomous private firms that are susceptible to analysis by an economic model of nonprofits. A study of public institutions could be undertaken as well, as this could inform the design of exchanges for electricity or carbon permits currently being considered, but this would introduce additional complexity that we believe is best deferred to future research.

Finally, our analysis demonstrates that nonprofit firms are susceptible to, and worthy of, analysis. This analysis is made the more difficult by nonprofits’ heterogeneity, but heterogeneity does not imply incomprehensibility, and with careful institutional analysis, important features of different nonprofits can be explained. Far from being a marginal phenomenon, nonprofits operate and sometimes dominate industries that most trouble policy makers, including health care, education, foreign aid and more. At stake in the case of stock exchanges is no less than our understanding of markets as a whole.

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28 Gertler and Kuan (2009) also find evidence of heterogeneous objective functions among nonprofits in the hospital industry.
References


Mandelbrot, Benoit (2009), Video interview with the Financial Times, September 30.


Table 1: Random Effects Difference in Differences in Bid-Ask Levels (OLS)

<table>
<thead>
<tr>
<th>Dep var = (ask-bid)/price</th>
<th>All Stocks</th>
<th>S&amp;P 500</th>
</tr>
</thead>
<tbody>
<tr>
<td>NYSE ((y = 1))</td>
<td>-0.022 *** (0.001)</td>
<td>-0.011 *** (0.002)</td>
</tr>
<tr>
<td></td>
<td></td>
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</tr>
<tr>
<td>After ((y = 1))</td>
<td>-0.006 *** (0.001)</td>
<td>-0.008 *** (0.002)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NYSE * After</td>
<td>0.010 *** (0.001)</td>
<td>0.012 *** (0.002)</td>
</tr>
</tbody>
</table>

**Controls**

<table>
<thead>
<tr>
<th></th>
<th>All Stocks</th>
<th>S&amp;P 500</th>
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</thead>
<tbody>
<tr>
<td>Earnings</td>
<td>-0.077 *** (0.003)</td>
<td>0.938 *** (0.160)</td>
</tr>
<tr>
<td>Size</td>
<td>N</td>
<td>Y</td>
</tr>
<tr>
<td>Industry</td>
<td>N</td>
<td>Y</td>
</tr>
<tr>
<td>Years</td>
<td>2000-2008</td>
<td>2001-2008</td>
</tr>
<tr>
<td>N</td>
<td>42,656</td>
<td>4020</td>
</tr>
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</table>

Notes: The symbol + indicates that the estimated coefficient is significantly different from zero at the 10 percent level, * indicates that is significant at the 5 percent level, and ** indicates significance at the 1 percent level.
Table 2: Fixed Effects Difference in Differences in Bid-Ask Trends (OLS)

<table>
<thead>
<tr>
<th></th>
<th>All Stocks</th>
<th>S&amp;P 500</th>
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</thead>
<tbody>
<tr>
<td><strong>Dep var = (ask-bid)/price</strong></td>
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<td></td>
</tr>
<tr>
<td>NYSE year trend</td>
<td>-0.002 *** (0.0002)</td>
<td>-0.000 (0.000)</td>
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<tr>
<td>NYSE year trend * After</td>
<td>0.012 *** (0.0009)</td>
<td>0.00002*** (0.000)</td>
</tr>
<tr>
<td><strong>Controls</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Earnings</td>
<td>-0.053 *** (0.003)</td>
<td>0.942 *** (0.169)</td>
</tr>
<tr>
<td>Size</td>
<td>N</td>
<td>Y</td>
</tr>
<tr>
<td>Industry</td>
<td>N</td>
<td>Y</td>
</tr>
<tr>
<td>Years</td>
<td>2001-2008</td>
<td>2001-2008</td>
</tr>
<tr>
<td>N</td>
<td>36,610 (7192 stocks)</td>
<td>4,020 (679 stocks)</td>
</tr>
</tbody>
</table>
Figure 1: Mean Bid-Ask Spread, NYSE and NASDAQ (1995-2008)
Figure 2: Difference in Bid-Ask Spreads (NASDAQ – NYSE), 1995-2008
Figure 3: Trend in Difference in Pre-Demutualization Spreads (NASDAQ, NYSE), 96-08
Figure 4: Trend in Difference in Pre-Demutualization Spreads (NASDAQ, NYSE), 95-06